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The Relation of University Extension
Work to Industrial Education

Electrical Engineer

1911

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THE RELATION OF UNIVERSITY EXTENSION WORK
TO INDUSTRIAL EDUCATION

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BY

DANIEL CLEVELAND FABER

B.S. UNIVERSITY OF ILLINOIS, 1908

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF

ELECTRICAL ENGINEER

IN

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1911

UNIVERSITY OF ILLINOIS
THE GRADUATE SCHOOL

April 13 1971

I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Mr. Daniel Cleveland Faber

ENTITLED *The Relation of University Extension work & Industrial Education*

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF

~~Master of Electrical Engineer~~

Eduard Berg
In Charge of Major Work

Eduard Berg
Head of Department

Recommendation concurred in:

Eduard Berg
G.A. Goodenough
A. Skarlicki

} Committee
on
Final Examination

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Introduction.

In this discussion of "The Relation of University Extension Work to Industrial Education", an effort will be made to show the position that Extension Work occupies with reference to other methods of Industrial Education:

First, by a general description and discussion of the various methods used in Industrial Training, by a description of work and results of a number of representative applications of each system, and by a discussion of the limitations of each of the systems in use.

Second, by a history and description of University Extension work, with special reference to the University of Wisconsin Extension Division, and the Milwaukee District in particular, including the methods of carrying on the work, courses offered, with representative assignments from different courses, description of classes and results obtained, and a discussion of the limitations and field of usefulness of University Extension and future development of the same.

The Relation of University Extension Work
to
Industrial Education.

The term industrial education is generally used to designate training for the intelligent pursuit of any trade, including both the practical and theoretical applications of the different processes of that trade. This term would apply equally well to training done entirely in schools for the purpose of educating the students for the practice of a trade after leaving school, or to the training of men already engaged in a trade, for a more skillful pursuit of the same.

Industrial education is an essential factor in the determination of the future prosperity of the industries of the nation. Manufactories and railroads have been expanding at a rapid rate, in fact at a much greater rate than skilled workers have been produced.

What might be termed general education, to distinguish it from "specialized" education has made great advances in the past century. Technical training has done the same. The engineering schools will supply the engineers, managers, etc., but these men comprise a very small per cent of the total number of industrial workers and those who can take advantage of the training offered by such schools are comparatively few.

If high industrial efficiency is to be maintained some method of securing a greater number of skilled workers must be found. Mr. C. R. Dooley covers the situation in an article in the Proceedings of the American Institute of Electrical Engineers, (Vol. 28, P. 1088) as follows:

"The present scarcity of skilled workmen is a matter of great moment to the manufacturer. He is vitally concerned in plans for the future that will insure men of all around skill in their respective lines. He may rely upon the engineering schools for the majority of his managers, but who will broaden and train his workmen?"

To meet this situation, many methods have been suggested and tried by corporations and communities; three of these, (1) the apprenticeship system and corporation school, (2) trade schools and (3) industrial schools, are well known.

Apprenticeship Systems.

The present day apprenticeship systems vary greatly in different trades, and, in different plants even where the same kind of work is done, and range from those in which an agreement is made with the apprentice for a number of years, at certain wages, but without any very definite system of shop training, to those in use by many of the largest and best industrial establishments of the country, where the apprentices are in the charge of a special offi-

cial, are given a chance to attend school in connection with their work, and are carefully instructed while doing work in the shop.

In all industries requiring skilled laborers there is a tendency toward the adoption of some general form of apprenticeship system, which will in a measure equalize conditions in the various plants. The larger and better organized plants and corporations see the advantage of training men for their own use, and are able to provide well for the training of apprentices, both by shop and theoretical instruction, expecting of course to keep a man in their employ after he has served his apprenticeship.

National Metal Trades Association.

The following agreement, in quite general use by the 500 or 600 members of the National Metal Trades Association, represents quite well the conditions of instruction, etc., under which the apprentice works in the average shop.

Rules and Conditions

Under which Apprentices are Received for Instruction at the Works of

(Firm's Name)

1st.

Applicants for apprenticeship under this agreement must have reached the age of 17 years.

2nd.

Apprentices are to work for us well and faithfully under the shop rules and regulations, for the term of 11520 hours, commencing with their first hour of service, as an apprentice, in such

capacity and on such work, whether in the line of _____ (Trade.) or otherwise, as the employer, foreman or agent may direct, and at such times and places as shall be appointed by the employer, whether it be full time, or short time, or overtime, it being expressly agreed, however, that the apprentice, upon finding the trade or art of _____ (Trade) uncongenial to himself, may within the first 720 hours of his employment terminate, upon six days' notice to his employer, the service upon which he entered.

3rd.

The employer reserves the right to suspend work in the shop wholly or in part, at any time it may be deemed necessary. In such case the apprentice shall be paid only for the actual time he shall work.

4th.

It is hereby also fully and clearly understood and agreed, and made a part of this agreement, that the employer reserves the right to, at any time, annul this agreement, and discharge the apprentice named herein without any further compensation than the hourly wages already paid to him if his conduct shall be in its opinion, detrimental to its interests, or to the good order of its shops or for repeated absence of the apprentice without leave, or if his want of application or ability as an apprentice shall be found such that his services, in the judgment of his said employer are not worth the wages paid to him, or for any other good and sufficient reason. In order to avoid proving such conduct, it is agreed that said dismissal for any of the causes aforesaid shall be final and conclusive evidence of the truth thereof. Upon such dismissal the

terms of apprenticeship shall end.

5th.

The employer's aim will be to give the Apprentice a fair opportunity for learning, and will endeavor to have him serve a reasonable length of time at all ordinary branches of the

_____ trade so that at the end of his apprenticeship he may have had the general experience which may qualify him, - if he has shown ability and faithfully applied himself, -- to become a journeyman _____. The apprentice must bear in mind that his advancement depends on his ability, diligence and industry.

Length of service will not entitle an apprentice to promotion. The Apprentice showing the most ability, diligence and industry will naturally be given the preference in advancement.

6th.

Overtime shall count on the 11520 hours; but all absences, except those resulting from injuries received while on duty and without contributory fault on the part of the apprentice shall be made up.

7th.

The said term of 11520 hours shall be divided into four periods of 2880 hours each, and the compensation shall be at the following rates:-

For the first period of 2880 hours _____ cents per hour.

For the second period of 2880 hours _____ cents per hour.

For the third period of 2880 hours _____ cents per hour.

For the fourth period of 2880 hours _____ cents per hour.

8th.

Each apprentice who has faithfully and satisfactorily completed his term of instruction, shall, in consideration of the full and satisfactory completion of this contract in accordance with these rules, be, on the signing of the appended certificate by us, setting forth that he has so completed his term, entitled to a bonus of one hundred (\$100.00) dollars, which shall be paid him on the first regular pay day following the completion of the aforesaid 11520 hours. This bonus is offered solely as an inducement to apprentices to fully and satisfactorily complete contracts, and, it is understood, no part thereof shall be deemed earned until the contract has been fully and satisfactorily completed. On such completion we bind ourselves to sign said certificate.

Milwaukee Metal Trades Association.

The Milwaukee Metal Trades Association comprising thirty-two metal working companies of Milwaukee and vicinity have four general forms of apprentice agreements, viz; The Four Year Minor Course, for boys who have had an equivalent of about the Eighth grade public school education, and who want to learn a trade; the Three Year Minor Course, for those who have been through two or more years of High School or have had a year or more experience in the shop; the Three Year Adult Course for men who have worked in the shop on some particular class of work for a number of years and are proficient in that work only, and who want to learn a trade; and the Two Year Adult Course for men of the same qualifications, but who instead of desiring to learn a trade, wish to become a specialist on

10
APPRENTICESHIP CONTRACT.

(FOUR YEARS—MINOR.)

This Agreement, made in duplicate this day of 191
at
between the party of the first part,
hereinafter called the Company, and

..... Write Name and Address of Apprentice above.

a minor, years of age on the day of 191
and Write Name of Parent or Guardian above.

of said minor, who by signing this agreement evidences his consent thereto, parties of the second part.

WITNESSETH: The Company, in consideration of the agreements hereinafter contained, to be performed by the second parties, hereby agrees to take said minor into its employ and service for a term of 11,000 hours commencing with the first hour of service after the date of this agreement and to give said minor an opportunity of learning the trade of

as carried on by the Company in its works and during and incident to the said term of service to give to the said minor the customary instruction and assistance in learning said trade.

The second parties agree that the said minor shall remain with and serve the Company for the full term of 11,000 hours, except that the minor may terminate his employment and this agreement at any time during the first 688 hours of the term of his service, upon giving six days' notice to the Company.

The second parties further agree that said minor shall diligently and faithfully work for and serve the Company during the said term in such branches of said trade as its superintendent may direct, and further that the minor shall at all times perform his work as faithfully and skillfully as he may be able to do and in all respects conform to and obey the rules and regulations of the Company in force at the date of this agreement and all rules and regulations that may hereafter be adopted for the government of its employees, and faithfully keep all the trade and business secrets of the Company.

It is further mutually agreed that should said minor fail to comply with any of the above requirements, or be repeatedly absent from his work without leave, or go out on any strike, or if his want of application or ability as an apprentice shall be found such that his services, in the judgment of the Company, are not worth the wages paid to him, or for any other good and sufficient reason, then the Company may annul this agreement and dismiss said minor without any further compensation than the hourly wages due or already paid him.

In consideration of the services and agreements to be performed by the second parties the Company agrees to pay said minor, who is hereby authorized to receive and receipt for the same, the following wages:—

For the first period of 2,750 hours	cents per hour.
For the second period of 2,750 hours	cents per hour.
For the third period of 2,750 hours	cents per hour.
For the fourth period of 2,750 hours	cents per hour.

It is further agreed that said wages shall be paid on the regular pay days of the works where said minor is employed; that all overtime shall be counted on said period of 11,000 hours at actual time worked and be paid for at the same rate proportionately as adult employees in the same shop or department are paid for overtime; and it is further mutually agreed that should said minor lose any time during any period of his term of service from any cause whatsoever, not the fault of the Company, or otherwise than by the command or with the consent of the Company, such lost time shall be fully made up by him and so made up before the said minor shall be considered as entering upon the next succeeding period of his service, and further that the Company may at any time suspend work in the shop in which said minor is employed and all time lost thereby shall be made up by said minor.

It is further covenanted and agreed that when said minor shall have fully completed his term of service of 11,000 hours, as heretofore provided, he shall be entitled to, is hereby authorized to receive, and shall be paid by the Company a bonus of \$ in addition to his regular wages, as a reward for the faithful performance of this agreement.

IN WITNESS WHEREOF, The parties have hereunto subscribed their names the day and year above written.

Parent or Guardian sign below.

..... Company.

[Seal]

By

(Seal)

[Seal]

Apprentice sign above.

No.

FOUR YEAR MINOR

Apprenticeship Contract

BETWEEN

AND

Dept.

DATE OF COMMENCEMENT

191

DATE OF COMPLETION

191

CERTIFICATE.

This is to certify that has fully and satisfactorily completed his full apprenticeship term of 11,000 hours (four years) as

Dated at , this day of

A. D. 191

..... Company.

By

APPRENTICESHIP CONTRACT.

(THREE YEARS—MINOR.)

This Agreement, made in duplicate this day of 191
 at
 between the party of the first part,
 hereinafter called the Company, and....

Write Name and Address of Apprentice above.

a minor, years of age on the day of 191
 and.....
 Write Name of Parent or Guardian above.

of said minor, who by signing this agreement evidences his consent thereto, parties of the second part.

WITNESSETH: The Company, in consideration of the agreements hereinafter contained, to be performed by the second parties, hereby agrees to take said minor into its employ and service for a term of 8,250 hours commencing with the first hour of service after the date of this agreement and to give said minor an opportunity of learning the trade of

as carried on by the Company in its works and during and incident to the said term of service to give to the said minor the customary instruction and assistance in learning said trade.

The second parties agree that the said minor shall remain with and serve the Company for the full term of 8,250 hours, except that the minor may terminate his employment and this agreement at any time during the first 688 hours of the term of his service, upon giving six days' notice to the Company.

The second parties further agree that said minor shall diligently and faithfully work for and serve the Company during the said term in such branches of said trade as its superintendent may direct, and further that the minor shall at all times perform his work as faithfully and skillfully as he may be able to do and in all respects conform to and obey the rules and regulations of the Company in force at the date of this agreement and all rules and regulations that may hereafter be adopted for the government of its employees, and faithfully keep all the trade and business secrets of the Company.

It is further mutually agreed that should said minor fail to comply with any of the above requirements, or be repeatedly absent from his work without leave, or go out on any strike, or if his want of application or ability as an apprentice shall be found such that his services, in the judgment of the Company, are not worth the wages paid to him, or for any other good and sufficient reason, then the Company may annul this agreement and dismiss said minor without any further compensation than the hourly wages due or already paid him.

In consideration of the services and agreements to be performed by the second parties the Company agrees to pay said minor, who is hereby authorized to receive and receipt for the same, the following wages:—

For the first period of 2,750 hours	cents per hour.
For the second period of 2,750 hours	cents per hour.
For the third period of 2,750 hours	cents per hour.

It is further agreed that said wages shall be paid on the regular pay days of the works where said minor is employed; that all overtime shall be counted on said period of 8,250 hours at actual time worked and be paid for at the same rate proportionately as adult employees in the same shop or department are paid for overtime; and it is further mutually agreed that should said minor lose any time during any period of his term of service from any cause whatsoever, not the fault of the Company, or otherwise than by the command or with the consent of the Company, such lost time shall be fully made up by him and so made up before the said minor shall be considered as entering upon the next succeeding period of his service, and further that the Company may at any time suspend work in the shop in which said minor is employed and all time lost thereby shall be made up by said minor.

It is further covenanted and agreed that when said minor shall have fully completed his term of service of 8,250 hours, as heretofore provided, he shall be entitled to, is hereby authorized to receive, and shall be paid by the Company a bonus of \$..... in addition to his regular wages, as a reward for the faithful performance of this agreement.

IN WITNESS WHEREOF, The parties have hereunto subscribed their names the day and year above written.

Parent or Guardian sign below.

Company.

[Seal] By

[Seal]

Apprentice sign above.

(Seal)

No.

THREE YEAR MINOR

Apprenticeship Contract

BETWEEN

AND

Dept.

DATE OF COMMENCEMENT

191....

DATE OF COMPLETION

191....

CERTIFICATE.

This is to certify that has fully and satisfactorily...

completed his full apprenticeship term of 8,250 hours (three years) as

Dated at , this day of

A. D. 191

Company,

By

APPRENTICESHIP CONTRACT.

(THREE YEARS-ADULT.)

This Agreement, made in duplicate this day of 191

at

between the party of the first part,

hereinafter called the Company, and.....

party of the second part.

Witnesseth: The Company in consideration of the agreements hereinafter contained, to be performed by the second party, hereby agree to take said second party into its employ and service for a term of 8,250 hours commencing with the first hour of service after the date of this agreement and to give said second party an opportunity of learning the trade of..... as carried on by the Company in its works and during and incident to the said term of service to give to the said second party the customary instruction and assistance in learning said trade.

The second party agrees to remain with and serve the Company for the full term of 8,250 hours, except that he may terminate his employment and this agreement at any time during the first 688 hours of the term of his service, upon giving six days' notice to the Company.

The second party further agrees to diligently and faithfully work for and serve the Company during the said term in such branches of said trade as its superintendent may direct, and further that he will at all times perform his work as faithfully and skillfully as he may be able to do and in all respects conform to and obey the rules and regulations of the Company in force at the date of this agreement and all rules and regulations that may hereafter be adopted for the government of its employees, and faithfully keep all the trade and business secrets of the Company.

It is further mutually agreed that should said second party fail to comply with any of the above requirements, or be repeatedly absent from his work without leave, or go out on any strike, or if his want of application or ability as an apprentice shall be found such that his services, in the judgment of the Company, are not worth the wages paid to him, or for any other good and sufficient reason, then the Company may annul this agreement and dismiss said second party without any further compensation than the hourly wages due or already paid him.

In consideration of the services and agreements to be performed by the second party the Company agrees to pay him the following wages:—

For the first period of 2,750 hours.....cents per hour.

For the second period of 2,750 hours.....cents per hour.

For the third period of 2,750 hours.....cents per hour.

It is further agreed that said wages shall be paid on the regular pay days of the works where said second party is employed; that all overtime shall be counted on said period of 8,250 hours at actual time worked and be paid for at the same rate proportionately as journeymen employees in the same shop or department are paid for overtime; and it is further mutually agreed that should said second party lose any time during any period of his term of service from any cause whatsoever, not the fault of said Company, or otherwise than by command or with the consent of the Company, such lost time shall be fully made up by him and so made up before the said second party shall be considered as entering upon the next succeeding period of his service, and further that the Company may at any time suspend work in the shop in which said second party is employed and all time lost thereby shall be made up by said second party.

In Witness Whereof, The parties have hereunto subscribed their names the day and year above written.

..... Company.

By

(Seal)

Apprentice sign above.

No.

THREE YEARS ADULT

Apprenticeship Contract

BETWEEN

AND

Dept.

DATE OF COMMENCEMENT

191

DATE OF COMPLETION

191

CERTIFICATE.

This is to certify that..... has fully and satisfactorily...

completed his full apprenticeship term of 8,250 hours (three years) as....

Dated at....., this..... day of

A. D. 191

..... Company.

By

APPRENTICESHIP CONTRACT.

(TWO YEARS—ADULT.)

This Agreement, made in duplicate this

day of

191

at

between the party of the first part,

hereinafter called the Company, and

.....
Write Name and Address of Apprentice above.

party of the second part.

Witnesseth: The Company in consideration of the agreements hereinafter contained, to be performed by the second party, hereby agree to take said second party into its employ and service for a term of 5,500 hours commencing with the first hour of service after the date of this agreement and to give said second party an opportunity of learning the trade of as carried on by the Company in its works and during and incident to the said term of service to give to the said second party the customary instruction and assistance in learning said trade.

The second party agrees to remain with and serve the Company for the full term of 5,500 hours, except that he may terminate his employment and this agreement at any time during the first 688 hours of the term of his service, upon giving six days' notice to the Company.

The second party further agrees to diligently and faithfully work for and serve the Company during the said term in such branches of said trade as its superintendent may direct, and further that he will at all times perform his work as faithfully and skillfully as he may be able to do and in all respects conform to and obey the rules and regulations of the Company in force at the date of this agreement and all rules and regulations that may hereafter be adopted for the government of its employees, and faithfully keep all the trade and business secrets of the Company.

It is further mutually agreed that should said second party fail to comply with any of the above requirements, or be repeatedly absent from his work without leave, or go out on any strike, or if his want of application or ability as an apprentice shall be found such that his services, in the judgment of the Company, are not worth the wages paid to him, or for any other good and sufficient reason, then the Company may annul this agreement and dismiss said second party without any further compensation than the hourly wages due or already paid him.

In consideration of the services and agreements to be performed by the second party the Company agrees to pay him the following wages:—

For the first period of 2,750 hours cents per hour.

For the second period of 2,750 hours cents per hour.

It is further agreed that said wages shall be paid on the regular pay days of the works where said second party is employed: that all overtime shall be counted on said period of 5,500 hours at actual time worked and be paid for at the same rate proportionately as journeymen employees in the same shop or department are paid for overtime: and it is further mutually agreed that should said second party lose any time during any period of his term of service from any cause whatsoever, not the fault of said Company, or otherwise than by command or with the consent of the Company, such lost time shall be fully made up by him and so made up before the said second party shall be considered as entering upon the next succeeding period of his service, and further that the Company may at any time suspend work in the shop in which said second party is employed and all time lost thereby shall be made up by said second party.

In Witness Whereof, The parties have hereunto subscribed their names the day and year above written.

.....
Company.

By

(Seal)

Apprentice sign above.

No.

TWO YEARS ADULT

Apprenticeship Contract

BETWEEN

AND

Dept.

DATE OF COMMENCEMENT

191

DATE OF COMPLETION

191

CERTIFICATE.

This is to certify that has fully and satisfactorily

completed his full apprenticeship term of 5,500 hours (two years) as

Dated at , this day of

A. D. 191

Company.

By

a certain machine or class of work. These courses are not materially different than those of the National Metal Trades Association, except in a few minor points, which seem particularly suited to Milwaukee conditions, and allow credit toward the completion of a course for both school and practical work, done before entering an apprenticeship. A certificate and cash bonus are usually given on the satisfactory completion of any of these courses, both of which tend to stimulate an apprentice's interest and efforts to remain in his work for the full length of time of his contract.

In any of these courses of apprenticeship productive work in the shop is the first consideration of the manufacturer, and the school work is an after consideration. Owing to the fact that an apprentice, in a comparatively short time can become an efficient worker in some special work or operation, there is the possibility that he will be kept on this particular work, to the exclusion of general instruction in his trade. For instruction as to the best methods of doing certain things in the shop, a beginner must necessarily depend on the intelligence and attitude of his foreman and fellow workers. Most boys in the ordinary process of learning a trade receive no theoretical instruction in the underlying mechanical principles whatever, for the reason that the manufacturer or shop operator feels that he cannot afford to supply this part of the boy's training.

American Railway Master Mechanic's Association.

The great railroads of the country have found it necessary to provide special preparation and instruction for apprentices in

order to have a sufficient supply of skilled men at all times. In 1898 the American Railway Master Mechanic's Association recommended the following "Code of Apprenticeship Rules", which was adopted by a large number of railroads.

1. A regular apprentice is one who has had no previous shop experience and is not a graduate of a technical institution.
2. No regular apprentice shall be taken into the shop below the age of 15 or after the age of 19 years.
3. No apprentice shall be taken into the shop who has not received the elements of a common-school education, and who does not give evidence of such capacity as to promise the ability to become a competent mechanic.
4. No apprentice shall be taken into the shop without the consent of his parents or lawful guardians, who shall execute such documents, including a release of the company from liability for accidents to the said apprentice, as the company may require.
5. The term during which an apprentice shall serve before receiving a certificate of apprenticeship shall not be less than three years nor more than five years.
6. There shall be a regular apprentice course framed for each shop, which course each apprentice shall go through during his term, the time to be spent on each class of work being defined, and such definition shall be observed as closely as practicable with due regard to the capacities and condition of the individual apprentice.
7. During the term of the apprenticeship a careful and proper record shall be kept of the work and progress of the apprentice,

and also of the general behavior and conduct, which record shall be entered on properly authorized blanks or books provided for the purpose, not less frequently than once every week during such term.

8. Each apprentice shall be paid for the work done by him upon a scale duly agreed upon and provided for in advance.
9. Under no circumstances shall the company assume any liability for the employment of an apprentice after the conclusion of his term.
10. On the conclusion of the term of apprenticeship, each apprentice shall be given a certificate in proper form, duly signed by the proper officer of the company, which shall set forth the length of the time which each apprentice has served and the work on which he has been engaged, as well as some indication of his general behavior during his term.
11. Apprentices who have already served part of a term in other shops or who have taken part of a course at a recognized technical institution, may be received under such modifications of the foregoing rules as may be deemed proper.

These courses like those of the Metal Trades Associations outlined above, do not provide for any definite instruction for the apprentice, and therefore are open to the same objection as the other.

New York Central Lines.

The New York Central lines, have adopted a system whereby

the apprentice receives theoretical instruction in connection with his shop work, in other words, the school is brought into the shop. The apprenticeship rules of the New York Central Lines, are here given for the purpose of comparison with those of the American Railway Master Mechanic's Association, and were put into effect in 1906.

- A. Boys under 17 or over 21 years are not to be accepted for employment as apprentices.
- B. Whenever possible, preference shall be given to sons of employees.
- C. Applicant must pass a medical examination, before the local medical officer, proving him to be sound physically and mentally. Eyesight not less than 20/30 in each eye, free from color blindness, and hearing not less than 20/30, or a similar examination in accordance with regulations that may be adopted.
- D. Applicant must have a good common-school education, sufficient to enable him to read and write the English language, to make out his application on a blank provided for the purpose, and to enable him to make the ordinary computations in simple arithmetic, including addition, subtraction, multiplication, and division of numbers of four figures, and must have a reasonable knowledge of common and decimal fractions.
- E. The chief officer at each shop will make the selection of apprentices from the applications, in conjunction with a representative of the department of apprenticeship, who shall sign the application paper.

- F. Each year of the apprenticeship shall consist of 300 working days worked; no allowance will be made for overtime, and the subject of allowance for time lost by the apprentices will be considered in each case, and if worthy the applicant will be given the next advance in rate by calendar time. In computing time for next advance in rate, a day shall be allowed for each day or part of a day worked, provided it is not less than the hours run at the shop. (It should be understood that this refers only to computing time for date of next advance in apprentice rate and has no reference to or bearing on the prevailing system of computing time of employees on the hourly basis for wages paid.)
- G. Credit in rate and time, not to exceed two years, may be given for previous work of the same class as that for which the apprenticeship course is served. Such credit is to be given only after written approval of the superintendent of apprentices.
- H. Applicants not showing an adaptability for the work should be dismissed as apprentices during the first six months, and may be transferred to other employment. Foremen and local instructors should pay particular attention and report instances of this kind.
- I. Apprentices to be subject to the same regulations in regard to discipline as any other employee of the company.
- J. At the expiration of apprenticeship, those who have satisfactorily completed their term shall receive certificates signed by the proper officials of the New York Central Lines.

K. Apprentices who have completed their courses as indicated by the award of the above-mentioned certificate, may continue in the employment of the company at such rates as their services are worth. They will be encouraged to continue their services at a shop other than the one in which they have served their apprenticeship. After gaining experience in another shop, they may be transferred to their home shop if desired. In employing mechanics at all shops, preference will be given those holding New York Central Lines apprenticeship certificates.

Applicants for admission to the course must be somewhat older than is usually required of apprentices, and must pass a satisfactory medical and mental examination. The effect of these particular regulations is to establish a higher standard in the courses.

All apprentices are under the charge of a general superintendent, and under local instructors in the division shops, who have charge of the boys as soon as they enter the employment of the Company.

A school is maintained by the company which the boys are compelled to attend, in which drawing is taught during working hours, the boys are paid for their time and have regular hours for school work. Practical problems bearing on the work that the apprentice is doing in the shop are prepared by the instructors, and form part of the instructional work of the school. These problems, which are chosen to furnish both theoretical and practical information, are worked by the student on his own time, the work being

submitted to the instructor for correction. The school work is really individual instruction, inasmuch as the courses are so arranged that the amount of work an apprentice does in the school courses, is dependent entirely upon his own activity and ability, so that the men starting the course together soon become separated as far as the lessons are concerned. The drawing courses and problems are such as suit the local conditions of the road, and thus fit conditions with which each apprentice is familiar, and furnish the most valuable instruction in connection with the shop work. An effort is made to fit those apprentices, showing particular ability, for responsible positions by assigning them to the drafting rooms and motive power departments, toward the end of their apprenticeship.

From the point of view of the railroad management this system has proven very satisfactory, in having increased the boy's productiveness due to increased knowledge and stimulated interest in his work; in attracting better classes of apprentices, and more of them than the old courses did; and in the fact that the officials of the road look forward to a class of men of greater skill and intelligence for carrying on the work of the road in the future. Ten shops of the system have these courses at present, and more probably will be installed in the future. During 1909 - 1910 there were 583 apprentices taking work in the Company's school.

The General Electric Co.

The General Electric Company in their Lynn, Mass., works have an apprenticeship system in which school work and shop work are

closely connected. The course is a four year one, except for boys who have had three years work in High School, who may have the course shortened to three years.

While the New York Central system is one in which a school is maintained in connection with the shop, the General Electric Co. have a two year course in their "training rooms" before the boy is definitely assigned to some department of the works. The educational courses comprise arithmetic, elementary algebra and trigonometry, mechanics, strength of materials, electricity, and mechanical drawing and designing, and such other subjects as may seem necessary to a thorough understanding of the principles of their trade. The school sessions are held during working hours and the boys receive the same pay as if they were working in the shop. Six hours a week, during ten months of the year is the regular amount of time spent in school work, so that at any one time from one-fifth to one-sixth of the number of apprentices in the works would be in school. The courses are adapted to the needs of the tradesman, as much as is possible, for example a tool maker apprentice would receive practical instruction in the design of jigs, dies, etc., and would be taught to make such drawings and sketches as would be required for repair parts or suggestions for better designs.

The main feature of this system, is of course the training room, in which the apprentice does his preliminary work. This training room covers about 10,000 square feet of floor area, and is equipped with over 100 representative machine tools, as well as

small tools for bench work. There is a stockroom, conducted on the same principles as the stockroom of a commercial shop. The instructor who is a practical mechanic, instructs the boys in the fundamental principles of their trade, and teaches them the most efficient method of performing shop operations, and the use of labor saving devices. One of the best features of the system of the training room is the use of apprentices, after they have learned well the principles of certain operations, as instructors for newer apprentices on the same kind of work. This means that the apprentice must be observing in all the points of an operation, before he can show another how to do it. After a man has served his time, from one and one-half to two and one-half years in the training room, he is transferred to some regular department of the works for the remainder of his period of apprenticeship.

The Westinghouse Electric and Manufacturing Co.

The Westinghouse Electric and Manufacturing Company has maintained a school for their apprentices the past two years. The school work is essentially the same as that of the General Electric Co., and the apprentices receive pay for the time spent in school. No "training rooms", as such, are maintained, although the apprentice is instructed in shop work, as he serves his time in the regular departments of the works. Boys are received as apprentices for the Machinists', Electrical Machinists', and Pattern Makers' trades, the requirements for admission being a common school education. In the class work, Mechanical Drawing and Shop Problems are

especially emphasized, the apprentice spending four hours per week on these subjects. The regular length of the course is four years.

Casino Technical Night School.

While not a part of the Westinghouse Electric & Manufacturing Company's apprenticeship system, the Casino Technical Night School, established in 1902 by the Westinghouse interests, is a considerable factor in educating the employees of this Company, and is kept up in a large measure by contributions from this Company. The aim of the school is to furnish such instruction to men engaged in the trades as will enable them to learn the fundamental principles of engineering, and shop practice. As the name of the school implies, instruction is given in the evening. The only qualification for admission to the first year's work is ability to carry the work, and any one not able to do so is given preparatory instruction. There is only one course of instruction which is called a course in "Practical Engineering" and is as follows:

First Year

First Term

Arithmetic
Mechanical Drawing
Wood Shop and Foundry Practice

Second Term

Algebra
Mechanical Drawing
Physics
Metal Shop Practice

Second Year

First Term

Algebra
Mechanical Drawing
Physics
Metal Shop Practice

Second Term

Algebra
Mechanical Drawing
Physics
Metal Shop Practice

Third Year

First Term

Plane Geometry
Mechanical Drawing
Electrical Physics
Theoretical Electricity
English

Second Term

Plane Trigonometry
Applied Electricity
Theoretical Electricity
Chemistry

Fourth Year

First Term

Mechanics and Strength of Materials
Applied Electricity
Theoretical Electricity
Steam Engine Theory

Second Term

Mechanics
Applied Electricity
Metallurgy
Steam Engine Practice

The employees of the Westinghouse Electric and Manufacturing Company are encouraged to attend the school, and the overtime and night work of those employees enrolled in the school, is so

arranged as not to interfere seriously with the school work. In 1909-1910, 250 men were enrolled.

General Discussion.

The apprenticeship system as a whole is in general favor with boys wishing to learn a trade, in that it gives them a chance to earn at least a small wage while they are learning the fundamentals of the trade, and then too the apprenticeship system appeals to most people as being the only practical way of learning a trade. Most workmen favor the system as it starts the boy at the very bottom of the ladder, as far as the trade is concerned, and in a measure eliminates the undesirable apprentices before they have reached the point where they could be called tradesmen. The system is in favor with most employers; first, because the apprentice can make money for his employer, on account of the low wage rate paid; and second, because the employer has a chance to train men for his shop and during the period of apprenticeship he can pick out the desirable men and ordinarily can retain them in his employ at the end of their apprenticeship if he so desires.

Many small manufacturing companies, who cannot afford to install an extensive apprenticeship system, for various reasons have been greatly in favor of the establishment of Trade Schools.

Trade Schools.

The object of the Trade School is to train workers for the practical pursuit of a trade, not only by the teaching of principles but by teaching methods peculiar to that trade. Its function is different than that of the Manual Training or Technical High School, in that its graduates must be able to step into the ranks of skilled labor, and take their places alongside the man who has learned his trade in commercial shop work if the Trade School as such is to be a success; and in order to do this must possess, first of all things, ability to perform well the shop operations connected with their particular trade. The Manual Training and Technical High School have the rather indefinite object of giving a boy some of the fundamental principles of a trade, leaving him to learn the practical points after leaving school.

In some communities where there has been a shortage of skilled workers, the Trade School was looked upon as offering a solution to the problem, as the method by which the supply of such labor could be increased.

Milwaukee School of Trades.

In Milwaukee, the Milwaukee School of Trades, was established to turn out first class workmen for the various trades. The requirements for admission are that a boy shall be sixteen years of age, able to read and write English, and to perform simple

arithmetical operations in fractions, etc. Day and evening sessions are held, tuition being free to resident students under twenty years of age. The trades taught are Pattern Making, Carpentry, Wood Working, Plumbing and Gas Fitting, Machinist Work and Tool Making. The courses of instruction consist of five branches in each trade, as follows:

1. Shop Practice and Trade Lectures.

2. Drawing

Mechanical Drawing
Isometric Drawing
Working Drawings
Mechanical Design
Architectural Drawing

Freehand Drawing

3. Shop Mathematics

Arithmetic
Algebra
Geometry
Trigonometry

4. Shop Inspection Trips

5. Practical Talks and Lectures.

The work is so arranged that about one-fourth of the student's time is devoted to instruction in mathematics, drawing, etc. and the remaining three-fourths is spent in actual shop practice. For each trade a well equipped shop is maintained, in which instruction is given in shop practice and methods, the work in as far as is possible is handled as in a commercial shop, work of a commercial grade being done, which is sold in the open market. The drawing courses are not intended to make draftsmen out of the students, but are of such a nature as to furnish a shop man with the necessary requirements for reading drawings, making sketches, etc. The shop

mathematics includes simple calculations, solution and use of formulas, construction of geometrical figures and geometrical solutions, laws of trigonometry and solution of triangles. The shop inspection trips are made through representative shops of Milwaukee and vicinity and in connection with each trip, a report must be submitted to the instructor in charge.

The courses in the Pattern Making, Machinist and Wood Working Trades are two years in length. The Plumbing course is one year in length.

In 1910 there were 19 graduates in the different courses, out of a total enrollment of 118 students, in the day courses. The shops for trade instruction have at no time had all the students they could accomodate; the machine shop being the most popular, but even this shop could accomodate about 75 per cent more students. Some very excellent work done by students is on exhibition at the rooms of the school.

Winona Technical Institute.

Winona Technical Institute, or The National Trade School, as it is known at present, located at Indianapolis, offers a large number of courses in trade instruction. Its object is to fit young men for actual work in Electricity, Machine and Building Trades, Foundry Work and Pattern Making, Chemistry, Pharmacy, Lithography and Printing. The requirements for admission are that the student be 16 years of age, and have a preparation equivalent to the Public School course, through the 8th grade. Tuition in the various departments is \$100.00 per year.

The most important department of the School is that devoted to the Machinist's trade. The course in this department is two years in length, and at the end of that time, if the student has done satisfactory work, he is given a certificate which is the equivalent of the certificate given at the end of an apprenticeship course in a commercial shop. Through the cooperation of certain manufacturing companies in the city of Indianapolis, students can spend part of their time in commercial shops while attending the school. The plan followed in part is for the student to spend one week in school work and the next in the shop of some one of these cooperating companies, then going back to the school work for a week, and so on, the instruction in class being such as is applicable to the shop work. A number of scholarships are awarded by associations of employers to boys of exceptional qualifications, these scholarships being in effect loans for five years, inasmuch as the student must pay back the amount of his scholarship in that time.

The school is supported partly by manufacturers' and other subscriptions, and partly by tuition fees.

At present the Institute is in the hands of a receiver, and it is expected that the city of Indianapolis will take over the organization and place it on a solid financial basis.

General Discussion.

In general, Trade Schools are encouraged by the manufacturers; by the small one who cannot afford an extensive apprenticeship system, because the Trade School increases his chances of securing skilled labor; and by the larger companies, who may have their own

system of training men, because they have a better chance of retaining their good men, since the Trade School will in a measure supply those plants, not having a training system of their own, with men.

Railroad officials say that the trade schools cannot supply them with satisfactory employees without additional training under the peculiar conditions of railroad service, inasmuch as railroad operation can be learned under no other conditions than by actual work in those operations. The trade school can unquestionably do much to raise the standard of skilled labor, in fact it has already done so. The main objection raised by most people to such schools, is that where the work cannot be carried on under the actual conditions of a commercial factory, it is almost impossible for the student to obtain the practical skill and efficiency of a good workman in such a factory, as the workman's time as a factor in production, cannot be demonstrated to the pupil.

Continuation Schools.

The term Continuation School is generally used to designate any school which offers an opportunity for people, while at work, to further their education. There are several classes of such schools in the United States, under the name of Evening Schools, either public or private; Correspondence Schools, and special Continuation Schools.

In many cities there are Public Evening Schools, maintained as a part of the regular school system. In these schools are taught many elementary subjects, such as spelling, grammar, arithmetic, etc., and there are usually classes in mechanical drawing, shop mathematics, algebra, geometry, etc., for boys in the trades who have had some elementary schooling. In the public evening school an effort is usually made to offer such courses as would be of benefit to workers, and those who have had none or little opportunity to attend the day schools. Many of these schools offer free courses, while others have a nominal tuition fee. Numerous private institutions offer evening courses of a technical as well as a general nature. Evening schools reach a large number of people of the working class, and do a great amount of good. The greatest drawback is, of course, the irregular attendance due to the facts that the instruction periods take the only time that a working man has for recreation, and that often after a day's work he is too tired to attend. A comparatively short time can be devoted to evening work, as

two hours is the longest time that can be spent in one evening, and still secure satisfactory results.

Correspondence schools reach a great many people, and give some very good courses. These schools, especially those teaching or offering technical subjects, have been very successful in a financial way, thus proving their popularity. Practically any course of study may be pursued by correspondence, with one school or another.

The so called Special Continuation Schools are the result of cooperation between existing schools and corporations, or are schools founded for the express purpose of affording working men an opportunity to further their education.

Cincinnati Continuation School.

The Cincinnati Continuation School was established in 1909, for the purpose of furnishing theoretical instruction for apprentices in the Cincinnati shops. The school is under the direction of the Board of Education, and is supported out of the Public School Fund. The students are regular apprentices in some shop, and are paid for the time spent in the school at the same rate as when they are in the shop. The time spent in school work, by any apprentice amounts to four hours a week, and it is of course the co-operation of the manufacturers in giving the apprentices this half day per week that makes the work of the school possible. The courses include Reading, Writing, Arithmetic and Shop Mathematics, Mechanical Drawing and some work on Civics and Citizenship. About 250 apprentices were enrolled in 1910.

University of Cincinnati.

A cooperative plan followed by the University of Cincinnati, has some of the same features as the Continuation School but the work is more extensive and advanced, and the apprentices are not paid for the time spent in the school work. The University offers special courses in Mechanical and Electrical Engineering, to apprentices of about thirty-five manufacturing plants in Cincinnati, who have agreed to cooperate with the University. The plan is for each Company to send a certain number of apprentices to the University for one week, and to have him work in the shop the next, and so on. These apprentices work in pairs, one being in the shop while the other is attending classes, so that at any one time only one-half the number of apprentices enrolled in class work are absent from the shop. These courses last six years and lead to the regular degrees. An apprentice in order to be admitted to the classes, must ordinarily have a High School education or its equivalent, although boys without these qualifications are often enrolled after a few months shop work if they have shown exceptional ability.

This plan has been in operation since 1906, and has proven very popular with employers, in raising the standard of their skilled labor, and with the apprentice because he has a chance to improve his education while at work, and he is practically certain of a good position when he has finished his school work and apprenticeship.

Fitchburg, Mass., High School.

In Fitchburg, Mass., a plan is carried out, which instead of placing a shop apprentice in school part of the time, takes a

High School boy and places him in a commercial shop one-half of his time, where he works for wages under the same conditions as other apprentices. In effect this training is about the same as the Cincinnati plan, as a boy gets his theoretical instruction in school and his shop training under commercial conditions. The High School is in session for forty weeks a year, and is under the direction of the Board of Education, and is supported by public funds. The first year is spent entirely in school work, and during the last three years the boy spends one-half of his time, alternate weeks in the shop, half the boys at any one time being in school and the other half in the shop. The instruction in school consists of Mathematics, Drawing, Physics, Mechanics, Chemistry and Electricity, and the shop work consists of instruction in the Machinists' trade.

The work of the various night schools in general educational subjects is well known, and as an example of night school work in technical subjects, the work of the Casino Technical Night School, East Pittsburg, Pa., has been described above, and the work of the Correspondence Schools is too well known for further discussion.

Unquestionably the Continuation School of some form is the agent for educating people who are already in the trades, and many teachers advocate the part time shop and school plan, as being the proper method of preparing a boy for a trade, in preference to the usual apprenticeship system or trade school, claiming that the apprenticeship system does not provide sufficient broad theoretical instruction, and that the trade school does not furnish practical and efficient shop practice.

University Extension.

The need of the extension of University work to reach those who cannot have the advantages of study in residence at a University, was recognized some time ago by various educators, on account of the relatively small number of persons who are able to take advantage of such institutions.

University Extension in the United States, as an active institution, dates from about 1890, when the matter was taken up by the Regents of the University of the State of New York, the first appropriation being made by the state in 1891. In 1892 extension courses were made a part of the educational system of the University of Chicago. Since 1892 extension work has been done by about thirty institutions with varying degrees of success.

Extension courses in general are given through systems of lectures, wherein regular extension lecturers give talks at different centers, in the territory served by these courses, where there are enough enrollments to warrant such; and by correspondence in districts thinly populated and not reached by lecturers.

At the present time there is a growing tendency on the part of institutions of higher learning, to extend their courses within the reach of those who are not able to attend the regular sessions of the institutions.

Justification of Extension Work in Wisconsin.

In 1907-08 there were, in the State of Wisconsin, 369,194 persons between the ages of seven and fourteen years, of whom 233,733 persons attended public schools for a period of twenty-four or more weeks. During the same period 44,924 were in attendance at private schools. While the actual numbers of persons of school age have been increasing each year, the percentage of these attending school has been about the same for a number of years, an average of 60 per cent of all persons of school age attending public schools. Data showing the number of persons finishing the Eighth grade and High School are not available for the State of Wisconsin. Conditions in the City of Milwaukee, while not representative of conditions all over the state are shown by the following figures for 1909-10:

Students enrolled in Public Schools	-	39,573
Students finishing Third Grade	-	2,333
Students entering High School	-	1,591
Students finishing High School	-	374

In addition to the above there are about 24,000 students in the parochial schools and about 6000 in other unclassified schools in the City of Milwaukee. Comparatively few of those entering the trades throughout the state are able to secure any training whatever along the line of their work.

The need for some wide spread system of training for people who work, and those who wish to further their education but who are unable to attend regular schools and Universities was recognized some time ago in the State of Wisconsin.

Summer School for Artisans.

In 1901, the Summer School for Artisans was opened at the State University as an attempt to provide special training for tradesmen and apprentices who could not attend the regular sessions of the University. These sessions are six weeks in length, and instruction is offered to machinists, draftsmen, electricians and other persons engaged in industrial pursuits, by courses of lectures and laboratory practice and experiments. The only requirements for admission to these courses is a fair knowledge of English and elementary arithmetic. The laboratory instruction is individual so that a man may progress as rapidly as his ability and previous experience will allow.

The courses offered in applied electricity are (1) Dynamos and Motors, (2) Electrical Wiring, (3) Meters, (4) Transformers, (5) Lighting, (6) Telephony, (7) Electric Batteries (8) Industrial Applications, (9) Elementary Theory of Alternating Currents.

Engine and Boiler Courses are (1) Theory of Heat, Steam Engines, and Boilers, (2) Instruments, (3) Testing, (4) Gas and Gasoline Engines, (5) Operating Gas Engines and Producers, (6) Compressed Air.

In shop practice instruction is offered in wood working, forge shop work and in machine shop practice.

The drawing courses consist of elementary mechanical drawing, descriptive geometry and methods of computation. For students with preparation in drawing, courses in machine design and power transmission are offered.

Courses in surveying are also offered.

University of Wisconsin Extension Division.

The Summer School for Artisans, however, did not reach the persons who were in greatest need of instruction and training, so a few years later the Extension Division of the University was organized, with four departments, as follows:

1. Correspondence Study.
2. Instruction by Lectures.
3. Debating and Public Discussion.
4. General Information and Welfare.

The University of Wisconsin catalogue states that:

"The object of this University in carrying on extension work is to serve the citizens of the commonwealth who are unable to attend established educational institutions, to stimulate and guide them in the pursuit of a higher and more effective education, to enable them to achieve more nearly the best things in life of which they are capable - in short, to build up an extra-mural university, which shall embrace the whole state and which shall have live, active members in every community in intimate connection with the mother institution."

"The constant aim of the Regents has been to make the University the center of every movement which concerns the interests of the state - to give every man a chance to get the highest education possible at the smallest practical cost - to bring the University and the home in close touch."

In addition to the above departments there are at present two districts, Milwaukee and Oshkosh, having local instructors who meet the men who are enrolled in the Extension Division work,

either for consultation or in classes, in the different shops and plants of the district.

The Extension Division organization is the same as any other department of the University, being in the charge of a Director, and having Professors and Instructors in the various departments. In each district there is a representative having charge of the work in that district. The courses are prepared by members of the Extension Division, or those members of the University faculty who give part of their time to Extension work. These courses represent an equivalent amount of work in the different departments of the University, a "unit course" representing the amount of work done in one Semester in a five hour per week subject in the resident courses of the University. Where practicable a unit course is divided into forty lessons or assignments.

For admission to the Extension courses no examination is required, the student filling out an application blank showing his previous schooling and experience, from which the department determines whether or not the applicant should be admitted to the courses desired. Whenever the department finds that a course is not to the best interests of the student a change of course or discontinuance is advised. The cost of a unit course is twenty dollars, or at the rate of fifty cents an assignment. The latter rate prevails where less than a unit course is elected. A student is expected to complete a unit course within one year from the date of registration, and in case a certificate showing completion of the course, or University credit is desired, an examination must be taken under University supervision at the end of the course.

The correspondence work is handled entirely by the Exten-

sion Division at Madison. When a registration is received, the first assignments of the course, with instructions for study and preparation of the lessons, are sent to the student, along with such other suggestions as may be needed. The assignments are sent to the student as fast as he can prepare them, two or three assignments being sent at one time, and the student is urged to work one lesson at a time and to have this lesson in a satisfactory condition before another is started.

Courses in Industrial Work.

The courses offered which are of special value to industrial workers are:

Electrical Engineering: Shop Mathematics, Mechanical Drawing, Mechanics, Strength of Materials, Mechanism, Magnetic and Electric Circuits, Dynano Electric Machinery, Alternating Currents, Alternating Current Machinery, Electric Lamps and Illumination, Heat, Central Electric Stations, Power Transmission and Distribution, Electric Wiring, Telephones, Meters and Metering, Testing, Electric Railways, Electric Batteries, Compressed Air, Air Brakes.

Mechanical Engineering: Shop Mathematics, Mechanical Drawing, Mechanics, Strength of Materials, Mechanism, Machine Elements and Design, Heat, Boilers, Steam Engines, Valve Gears, Gas Engines and Producers, Test Methods, Lubricants, Refrigeration, Heating and Ventilation, Power Plants, Compressed Air, Locomotive Maintenance, Air Brakes, Economics of Train Operation, Electric Machinery, Engine Running, Fuels, Locomotives, Central Station Design.

Structural Engineering: Mathematics, Mechanical Drawing,

Strength of Materials, Elements of Structures, Roof Trusses, Plate Girder Bridges, Bridge Trusses, Timber and Combination Bridges, Masonry Structures, Reinforced Concrete Construction, Structural Drafting.

The fundamental subjects in the training of shopmen, among whom is found the greatest need in industrial training, are of course shop mathematics and drawing.

Shop Mathematics.

The course in shop mathematics includes; Arithmetic involving Fractions, Decimals, Ratio and Proportion, Percentage and Average, Squares, Cubes and Powers, Practical Problems in the Weights of Metals, Speeds of Pulleys, etc.

Algebra, the explanation of Symbols, Addition, Subtraction, Multiplication and Division, Factors, Formulas, Equations.

Shop Mechanics, including Strength of Materials, Work, Power, Energy, Horsepower of belts and engines, Levers, Wheel and Axle, Tackle Blocks, Inclined Plane and Jackscrow.

Geometry, Construction of Simple Figures and Use of Instruments, Measurement of Angles, Calculations of Volume and Surface.

Trigonometry, the Functions of Angles, Use of Tables, Solution of Right Triangles, Screw Threads, Obtuse Angles, Solution of Practical Problems, Laws of Sines, Cosines and Tangents.

Logarithms, Explanation and Use of Tables, Solution of Practical Problems, the Slide Rule.

Graphics, Graphical Solutions of Simple Problems, Curve Plotting.

In the above course the explanatory matter is supplemented by practical problems involving the principles of the lesson. This course is usually the first one in which a practical shop man is enroled. The following extracts and problems are representative of the course:

III-2. Four bolts are required; 2 3/4", 1 7/8", 2 5/16" and 1 13/32" long. How long a piece of iron will be required, from which to cut them, allowing 5/4" altogether, for cutting off and finishing their ends?

IV-7. How many steel pins, to finish 1 1/8" long, can be cut from an 8 foot rod, if we allow 3/16" inch to each pin for cutting off?

VIII-1.

Weight of Metals.

	Cu. In.	Cu. Ft.
Wrought Iron.....	.28 Lbs.	480 Lbs.
Cast Iron.....	.26 "	450 "
Steel (Soft).....	.28 "	480 "
Cast Steel.....	.29 "	496 "
Brass.....	.30 "	520 "
Copper.....	.32 "	550 "
Lead.....	.41 "	711 "

Example.

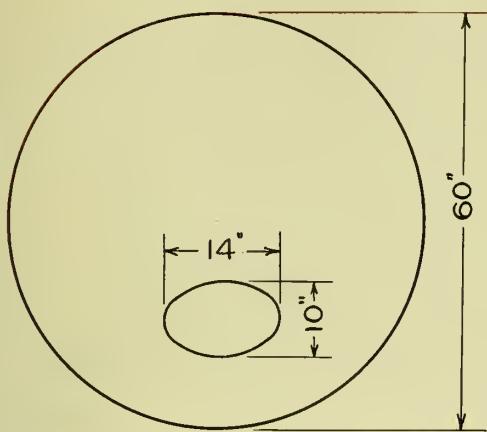
Find the weight of a piece of steel shafting 2 inches in diameter and 20 feet long,

Ans. 211.12 lbs.

IX-5. A 12" lineshaft pulley runs 280 R. P. M. and is belted to a machine running 70 R. P. M. What must be the size of the pulley on this machine?

X-7. A square nut for a 2" bolt is 3 1/8" on each side. What is the length of the diagonal or distance across corners?

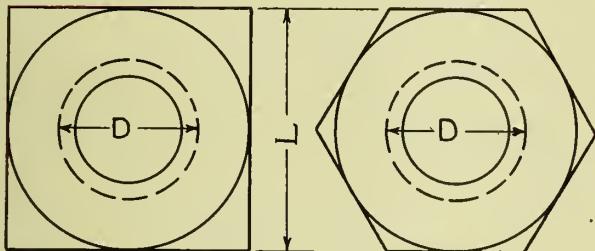
XII-4



A circular piece of boiler plate $\frac{3}{8}$ " thick and 60" diameter has an elliptical hole in it, 14" x 10".
Find the weight of the plate.
(Note; Area of an ellipse = $.7854 \times$ short diameter x long diameter.)

XV-4.

Dimensions of Nuts.



The dimension L , of a nut equals one and one half times the diameter of the bolt, plus one eighth of an inch, or;

$$L = 1\frac{1}{2} D + \frac{1}{8} \text{ (in inches)}$$

Find L for bolts whose diameters are: $\frac{1}{2}$ ", 1", $1\frac{1}{2}$ ", 2", 3".

XX-9. Write out the formula for the surface speed of an emery wheel, letting S stand for the surface speed of the wheel in feet per minute, D the diameter in inches, and N the number of revolutions per minute.

XXII-4. What force would be necessary to shear off a bar of machinery steel 2" in diameter?

XXIV-1. Find the H. P. of a 32" x 54" steam engine running at a speed of 94 R. P. M., with a M. E. P. (Mean Effective Pressure) of 60 lbs. In giving the dimensions of an engine cylinder the first number is the diameter and the second is the length of the stroke.

XXIX-4. The outside diameter of a steam cylinder head is 10"; the head is bolted on with six studs, spaced equidistant; the centers of the holes to be one inch from the edge of the head. How far apart are the stud centers?

XXXVIII-5. Find the value of 4.376^3 , by use of logarithms.

XL-6. A hollow shaft, the outside diameter of which is 6", is to weigh 60% of the same shaft if solid. Find the diameter of the hole.

Mechanical Drawing.

The elementary course in Mechanical Drawing, consists of practical drawing plates, with instructions, data sheets, etc., embracing; The Use of Instruments, Geometrical Construction, Simple Working Drawings, Detail and Assembly Drawings, Machine Parts, Screw Threads, Lettering and Tracing.

For those men who wish to go into drafting work, this course forms the basis for future work.

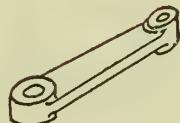
The idea in giving this course to shop men, is not to make draftsmen of them, but to enable them to read blueprints, make sketches of parts, etc. The tables accompanying the assignments, are of practical value to the shopman, aside from their value in the course.

The following sketches and data sheets are representative of the course; the instructional matter being omitted.

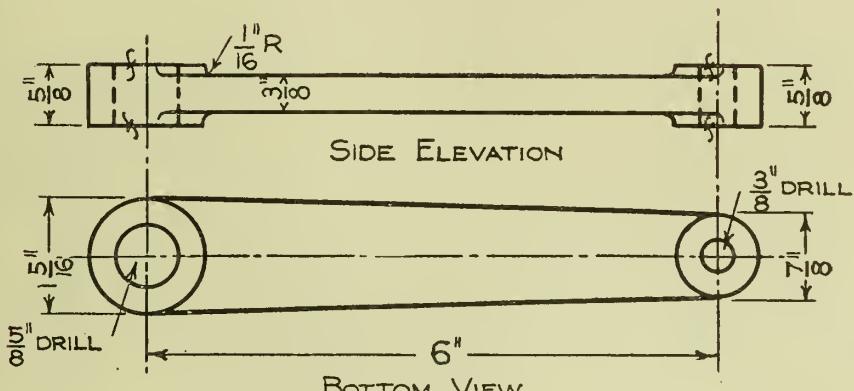
THE UNIVERSITY OF WISCONSIN, EXTENSION DIVISION, COR. STUDY DEPT.
 ENGINEERING COURSE 204, MECHANICAL DRAWING



DRAW THESE VIEWS.



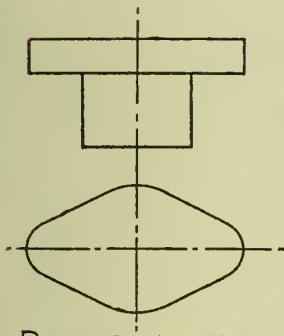
SKETCH SHOWING HOW
 LEVER WOULD LOOK
 VIEWED FROM THE
 CORNER.



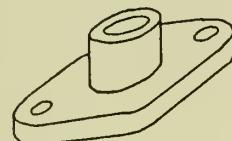
LEVER
 2 - CAST IRON

FIG. 3-1.

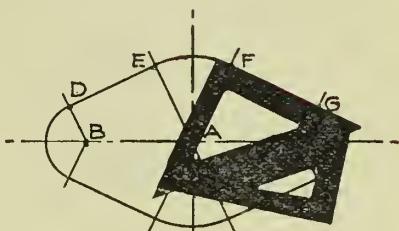
THE UNIVERSITY OF WISCONSIN, EXTENSION DIVISION, COR. STUDY DEPT.
ENGINEERING COURSE 204, MECHANICAL DRAWING



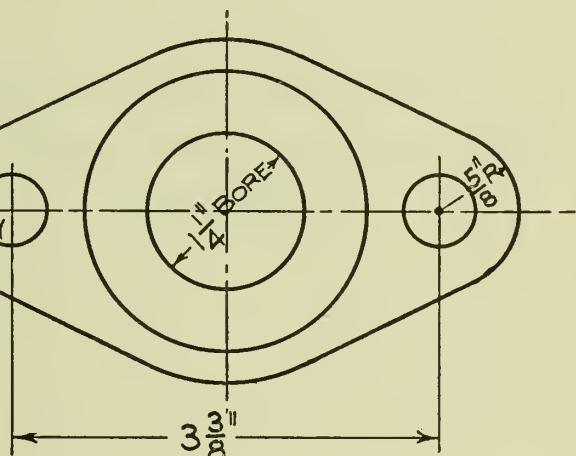
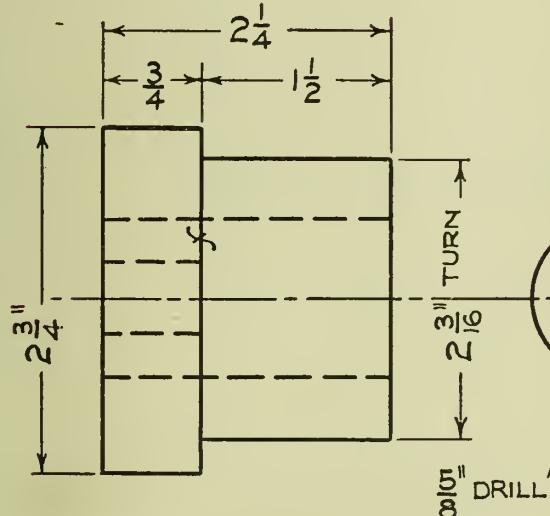
DRAW THESE VIEWS



SKETCH SHOWING
HOW GLAND WOULD
LOOK IF VIEWED
CORNERSIDE



SKETCH SHOWING HOW
LENGTHS OF ARCS ARE
FOUND

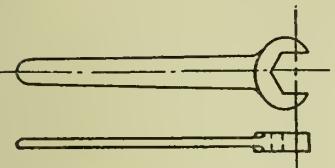


STUFFING Box GLAND
2 BRASS

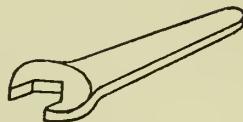
FIG. 4-1.

THE UNIVERSITY OF WISCONSIN, EXTENSION DIVISION, COR. STUDY DEPT.

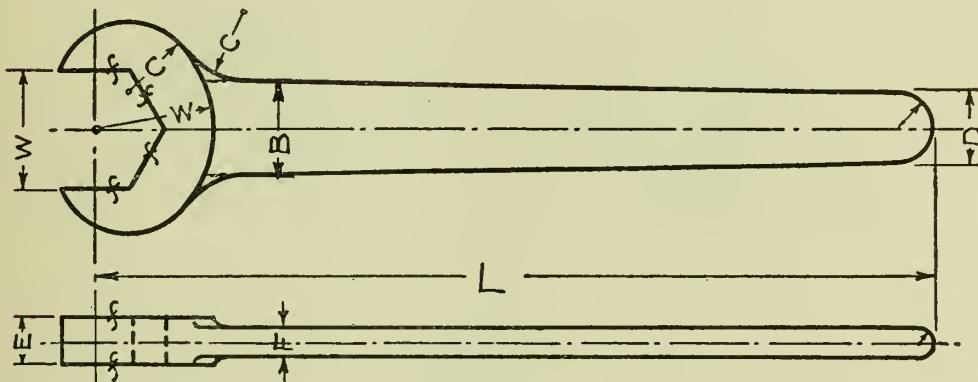
ENGINEERING COURSE 204, MECHANICAL DRAWING



DRAW THESE VIEWS.

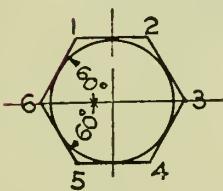


SKETCH SHOWING HOW
WRENCH WOULD LOOK IF
VIEWED CORNERWISE.



$\frac{3}{4}$ SINGLE END HEXAGON WRENCH
DROP FORGING

FIG. 5-1.



SKETCH SHOWING HOW
HEXAGON IS DRAWN.

FIG. 5-2.

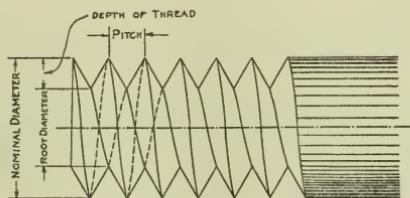


FIG. 6-1

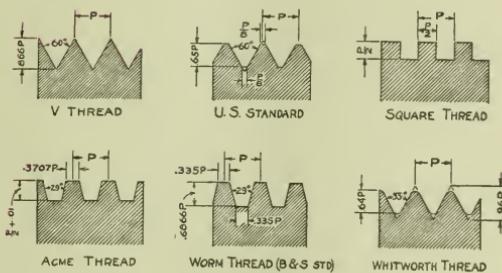
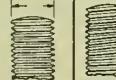
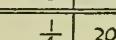
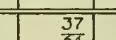
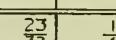
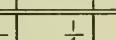
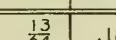
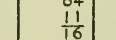
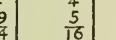
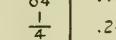
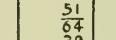
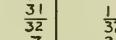
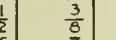
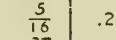
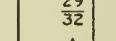
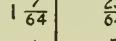
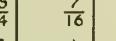
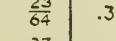
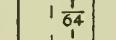
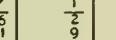
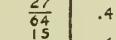
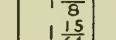
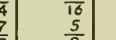
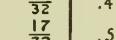
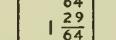
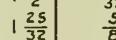
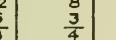
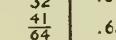
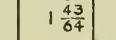
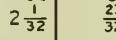
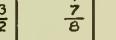
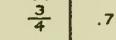
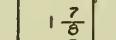
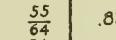
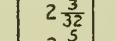
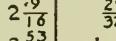
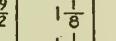
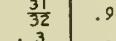
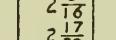
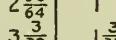
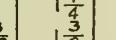
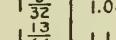
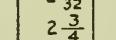
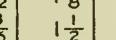
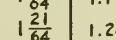
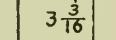
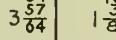
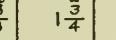
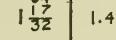
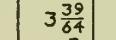
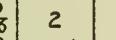
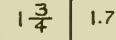
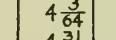
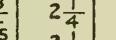
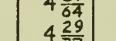
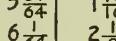
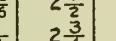
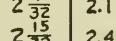
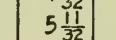
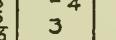
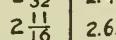
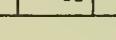
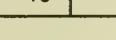
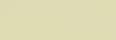
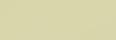
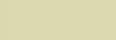


FIG. 6-2

ASSIGN 6
TABLE ATABLE OF DIMENSIONS OF U.S. STANDARD BOLTS, HEADS, & NUTS
ROUGH

DIAM. OF BOLT	NO. OF THDS PER INCH	SHORT DIAM OF HEXAGON OR SQUARE  DIST. ACROSS FLATS	LONG DIAMETER OF HEADS & NUTS		THICKNESS HEXAGON & SQUARE		DIAM. OF TAP DRILL  NEAREST 64"	ROOT DIAMETER 
			HEXAGON	SQUARE	HEADS	NUTS		
$\frac{1}{4}$	20	$\frac{1}{2}$  DIST. ACROSS FLATS	37  DIST. ACROSS CORNERS	23  DIST. ACROSS CORNERS	$\frac{1}{4}$  DIST. ACROSS FLATS	$\frac{1}{4}$  DIST. ACROSS FLATS	$\frac{13}{64}$	.185
$\frac{5}{16}$	18	$\frac{19}{32}$  DIST. ACROSS FLATS	11  DIST. ACROSS CORNERS	27  DIST. ACROSS CORNERS	$\frac{19}{64}$  DIST. ACROSS FLATS	$\frac{5}{16}$  DIST. ACROSS FLATS	$\frac{1}{4}$	.240
$\frac{3}{8}$	16	$\frac{31}{32}$  DIST. ACROSS FLATS	51  DIST. ACROSS CORNERS	31  DIST. ACROSS CORNERS	$\frac{11}{32}$  DIST. ACROSS FLATS	$\frac{3}{8}$  DIST. ACROSS FLATS	$\frac{5}{16}$	.294
$\frac{7}{16}$	14	$\frac{25}{32}$  DIST. ACROSS FLATS	29  DIST. ACROSS CORNERS	7  DIST. ACROSS CORNERS	$\frac{29}{64}$  DIST. ACROSS FLATS	$\frac{7}{16}$  DIST. ACROSS FLATS	$\frac{23}{64}$	.344
$\frac{1}{2}$	13	$\frac{7}{8}$  DIST. ACROSS FLATS	1  DIST. ACROSS CORNERS	$\frac{1}{64}$  DIST. ACROSS CORNERS	$\frac{1}{4}$  DIST. ACROSS FLATS	$\frac{7}{16}$  DIST. ACROSS FLATS	$\frac{27}{64}$	.400
$\frac{9}{16}$	12	$\frac{31}{32}$  DIST. ACROSS FLATS	$\frac{1}{8}$  DIST. ACROSS CORNERS	$\frac{3}{8}$  DIST. ACROSS CORNERS	$\frac{64}{64}$  DIST. ACROSS FLATS	$\frac{9}{16}$  DIST. ACROSS FLATS	$\frac{15}{32}$	.454
$\frac{5}{8}$	11	$\frac{1}{16}$  DIST. ACROSS FLATS	15  DIST. ACROSS CORNERS	64  DIST. ACROSS CORNERS	$\frac{1}{2}$  DIST. ACROSS FLATS	$\frac{17}{32}$  DIST. ACROSS FLATS	$\frac{17}{32}$	.507
$\frac{3}{4}$	10	$\frac{1}{4}$  DIST. ACROSS FLATS	29  DIST. ACROSS CORNERS	25  DIST. ACROSS CORNERS	$\frac{5}{32}$  DIST. ACROSS FLATS	$\frac{3}{4}$  DIST. ACROSS FLATS	$\frac{41}{64}$	.620
$\frac{7}{8}$	9	$\frac{1}{16}$  DIST. ACROSS FLATS	43  DIST. ACROSS CORNERS	$2\frac{1}{32}$  DIST. ACROSS CORNERS	$2\frac{1}{32}$  DIST. ACROSS FLATS	$\frac{7}{8}$  DIST. ACROSS FLATS	$\frac{3}{4}$	.731
1	8	$\frac{5}{8}$  DIST. ACROSS FLATS	7  DIST. ACROSS CORNERS	$2\frac{19}{64}$  DIST. ACROSS CORNERS	$1\frac{13}{16}$  DIST. ACROSS FLATS	$\frac{13}{16}$  DIST. ACROSS FLATS	$\frac{55}{64}$	.837
$1\frac{1}{8}$	7	$1\frac{13}{16}$  DIST. ACROSS FLATS	$2\frac{3}{32}$  DIST. ACROSS CORNERS	$2\frac{9}{16}$  DIST. ACROSS CORNERS	$2\frac{29}{32}$  DIST. ACROSS FLATS	$1\frac{1}{8}$  DIST. ACROSS FLATS	$\frac{31}{32}$	.940
$1\frac{1}{4}$	7	2  DIST. ACROSS FLATS	$2\frac{5}{16}$  DIST. ACROSS CORNERS	$2\frac{53}{64}$  DIST. ACROSS CORNERS	1  DIST. ACROSS FLATS	$1\frac{1}{4}$  DIST. ACROSS FLATS	$1\frac{3}{32}$	1.065
$1\frac{3}{8}$	6	$2\frac{3}{16}$  DIST. ACROSS FLATS	$2\frac{17}{32}$  DIST. ACROSS CORNERS	$3\frac{3}{32}$  DIST. ACROSS CORNERS	$1\frac{3}{32}$  DIST. ACROSS FLATS	$1\frac{3}{8}$  DIST. ACROSS FLATS	$1\frac{13}{64}$	1.160
$1\frac{1}{2}$	6	$2\frac{3}{8}$  DIST. ACROSS FLATS	$2\frac{3}{4}$  DIST. ACROSS CORNERS	$3\frac{23}{64}$  DIST. ACROSS CORNERS	$1\frac{3}{16}$  DIST. ACROSS FLATS	$1\frac{1}{2}$  DIST. ACROSS FLATS	$1\frac{21}{64}$	1.284
$1\frac{3}{4}$	5	$2\frac{3}{4}$  DIST. ACROSS FLATS	$3\frac{3}{16}$  DIST. ACROSS CORNERS	$3\frac{57}{64}$  DIST. ACROSS CORNERS	$1\frac{3}{8}$  DIST. ACROSS FLATS	$1\frac{3}{4}$  DIST. ACROSS FLATS	$1\frac{3}{32}$	1.491
2	$4\frac{1}{2}$	$3\frac{1}{8}$  DIST. ACROSS FLATS	$3\frac{39}{64}$  DIST. ACROSS CORNERS	$4\frac{27}{64}$  DIST. ACROSS CORNERS	$1\frac{9}{16}$  DIST. ACROSS FLATS	2  DIST. ACROSS FLATS	$1\frac{3}{4}$	1.712
$2\frac{1}{4}$	$4\frac{1}{2}$	$3\frac{1}{2}$  DIST. ACROSS FLATS	$4\frac{3}{64}$  DIST. ACROSS CORNERS	$4\frac{61}{64}$  DIST. ACROSS CORNERS	$1\frac{3}{4}$  DIST. ACROSS FLATS	$2\frac{1}{4}$  DIST. ACROSS FLATS	2	1.962
$2\frac{1}{2}$	4	$3\frac{7}{8}$  DIST. ACROSS FLATS	$4\frac{31}{64}$  DIST. ACROSS CORNERS	$5\frac{31}{64}$  DIST. ACROSS CORNERS	$1\frac{15}{16}$  DIST. ACROSS FLATS	$2\frac{1}{2}$  DIST. ACROSS FLATS	$2\frac{7}{32}$	2.176
$2\frac{3}{4}$	4	$4\frac{1}{4}$  DIST. ACROSS FLATS	$4\frac{29}{32}$  DIST. ACROSS CORNERS	$6\frac{1}{64}$  DIST. ACROSS CORNERS	$2\frac{1}{8}$  DIST. ACROSS FLATS	$2\frac{3}{4}$  DIST. ACROSS FLATS	$2\frac{15}{32}$	2.426
3	$3\frac{1}{2}$	$4\frac{5}{8}$  DIST. ACROSS FLATS	$5\frac{11}{32}$  DIST. ACROSS CORNERS	$6\frac{17}{64}$  DIST. ACROSS CORNERS	$2\frac{5}{16}$  DIST. ACROSS FLATS	3  DIST. ACROSS FLATS	$2\frac{11}{16}$	2.629

ASSIGN. 7
TABLE B.

DIMENSIONS OF A.S.M.E. STANDARD MACHINE SCREWS

No.	THREADS PER INCH 	DIAMETER OF BODY 	DIAM. OF FLAT HEAD  2D-.008	DIAM. OF ROUND HEAD  1.85D-.005	DIAM. OF FILLISTER HEAD  1.64D-.009	LENGTHS
0	80	.060	.112	.106	.0894	1/8" to 3/8"
1	72	.073	.138	.130	.1107	1/8 " 3/8
2	64	.086	.164	.154	.1320	3/16 " 1/2
3	56	.099	.190	.178	.1530	3/16 " 5/8
4	48	.112	.216	.202	.1747	3/16 " 3/4
5	44	.125	.242	.226	.1960	3/16 " 7/8
6	40	.138	.262	.250	.2170	3/16 " 1
7	36	.151	.294	.274	.2386	1/4 " 1 1/8
8	36	.164	.320	.298	.2599	1/4 " 1 1/4
9	32	.177	.346	.322	.2813	1/4 " 1 3/8
10	30	.190	.372	.346	.3026	1/4 " 1 1/2
12	28	.216	.424	.394	.3452	3/8 " 1 3/4
14	24	.242	.472	.443	.3879	3/8 " 2
16	22	.268	.528	.491	.4305	3/8 " 2 1/4
18	20	.294	.580	.539	.4731	1/2 " 2 1/2
20	20	.320	.632	.587	.5158	1/2 " 2 3/4
22	18	.346	.682	.635	.5584	1/2 " 3
24	16	.372	.732	.683	.6010	1/2 " 3
26	16	.398	.788	.731	.6437	3/4 " 3
28	14	.424	.840	.779	.6863	7/8 " 3
30	14	.450	.892	.827	.7270	1 " 3

Lengths vary by 1/16 inch from 3/16" to 1/2" length, by 1/8 inch from 1/2" to 1 1/2", and by 1/4 inch from 1 1/2 to 3 inches.

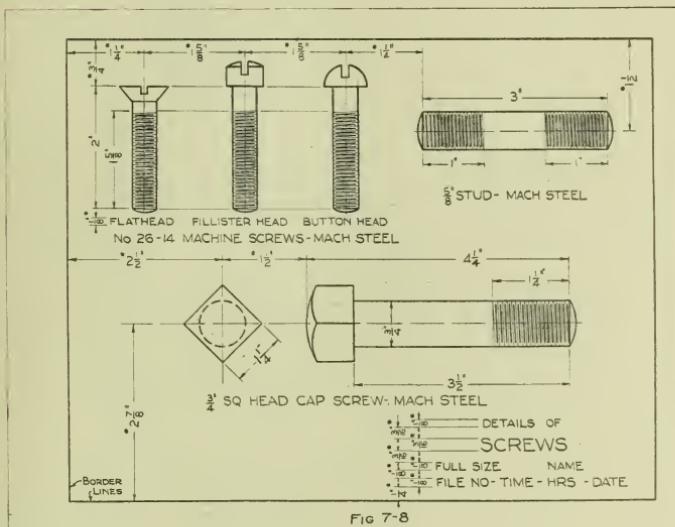


FIG 7-8

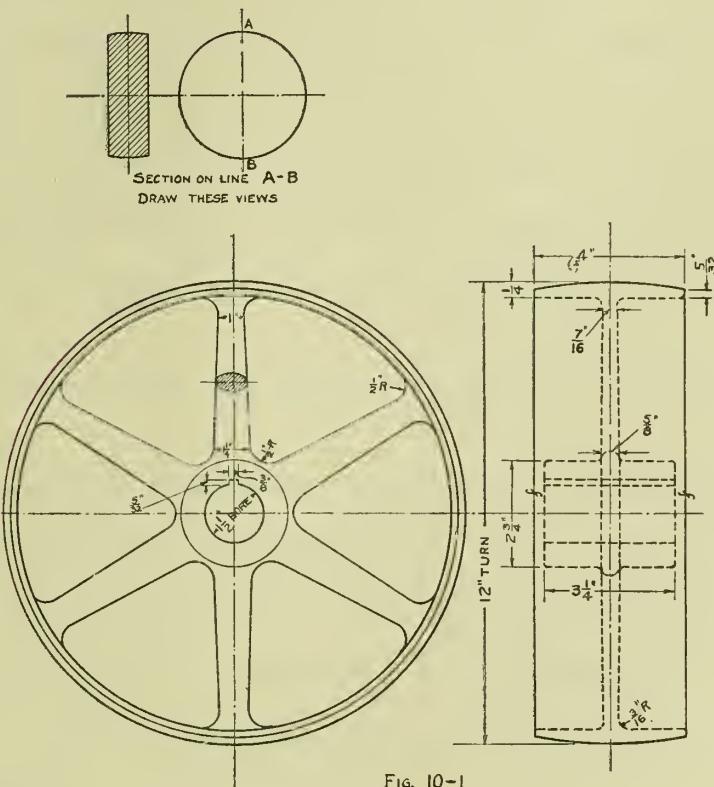


FIG. 10-1

1 PULLEY-CAST IRON

The other industrial courses are of less general interest, as they are for workers who have made considerable advance in their trade, or those who have had the advantages of preliminary work or courses of study. The subjects of the different courses give an idea of the matter treated.

In addition to the inaustral courses outlined above, the Extension Division offers courses in Business subjects, courses for University entrance credit, and courses of University grade.

Where class organization has been possible, a combination of correspondence and personal instruction has been found to be a very satisfactory method of teaching industrial subjects. The University first tried this method in the Milwaukee District.

Condition of Labor and Shops in Milwaukee.

In the manufacturing district of Milwaukee, there are practically one fifth of the people of the State, and in this same district, 75 per cent of the total manufacturing of the State is done. The population of the city of Milwaukee, in round numbers, is 380,000, and there are about 4000 manufacturing plants and about 105,000 employees.

The apprentice contracts of The Milwaukee Metal Trades Association are the direct result of local shop and labor conditions. Apprenticeship systems exist in name only, as far as instruction is concerned, as there are few apprentices, and the manufacturers feel that they cannot afford to put any extensive systems into effect. This condition has existed a long time in Milwaukee, so that the tradesmen as a class are not of a very high grade. The chart shows

STUDENTS

ENROLLED IN PUBLIC SCHOOLS - 39,573

FINISHING 8TH GRADE - 2333

ENTERING HIGH SCHOOLS - 1591

FINISHING HIGH SCHOOL - 374

CHART
OF
SCHOOL ATTENDANCE
FOR THE
CITY OF MILWAUKEE
1909-10.

the Public School situation in Milwaukee, which has been mentioned above. Comparatively few men who enter the trades have received more than an 8th grade education, and a surprisingly large number have never gone beyond the 6th grade. Very few tradesmen have received any special training whatever along the line of their work.

Organization and Conduct of Classes.

The University of Wisconsin Extension Division has organized 27 classes in industrial subjects in the Milwaukee District, the work being done partially by correspondence. These classes are met weekly or bi-weekly; during working hours on company time, where the men are all employed in one plant, and the company is willing to give them the time for class work; or in the evening or outside of working hours, where the company is not willing to give the men the time for class work, or the men are not all in one plant. Very few of the classes are met under the same conditions, as will be seen from the description of the different classes.

Before a class can be opened in a shop, the plant management must be interviewed, and permission obtained to hold the class in the plant, after which the employees may be approached by the organizer under favorable conditions. In all the classes, established in the Milwaukee district at present, the student stands the expense of his course; the various companies furnishing class rooms, and in many cases giving their employees the time to attend the class meetings if they enroll.

Apprentice Classes.

The Cutler-Hammer and Bucyrus Companies, have cooperated with the Extension Division in organizing apprentice classes in their plants.

The Cutler-Hammer class is made up of ten men from the different departments of the works, recommended by their respective foremen and approved by the shop superintendent and the Extension Division. The men in this class are not apprentices in the true sense of the word, as the company has no agreement with them. They are given one half day per week, with pay, to be devoted to class work, and are expected to attend class regularly, their time while in class being kept subject to shop rules for loss of time due to absence, lateness, etc.

The work outlined for the first year consists of shop mathematics and mechanical drawing courses requiring about eight months to complete. The mathematics course is the regular shop course, outlined above, the assignments being sent out from Madison and the work corrected there, although the work is done under the direction of the local instructor. The drawing is made up from assignments from the regular shop course, and problems involving sketching and drawing of apparatus and parts peculiar to the Cutler-Hammer shops. The drawing work is entirely in the hands of the local instructor, who is thus able to adapt the work to the individual needs of each man.

The time spent in the class room amounts to $3 \frac{1}{2}$ hours per week, and is divided as follows: Mathematics, 1 hour; Mechanical Drawing, 2 hours; and subjects of general interest in the work, and

to the men, 1/2 hour.

The work is done in a class room furnished by the company.

Monthly reports are sent to the plant superintendent, showing the progress of each student. Students whose work does not come up to standard, are requested by the management to give up the class room work, and another man is put in his place. The corrected work is kept on file for the inspection of the management, should it be desirable at any time to see how any man is progressing.

The cost of the course is borne by the student, and amounts to \$21.50, for the year, paid in installments of \$3.00 per month. Each student furnishes his own drawing instruments, etc.

The men in the plant eagerly seek a chance to enter this class.

In the Bucyrus Company's class, there are 14 regular apprentices, who receive instruction in shop mathematics and drawing, one half day per week, under practically the same conditions as at the Cutler-Hammer plant.

In both of these plants the men are visited frequently at their work, by the instructor, who thus becomes familiar with the man's work and his practical ability.

Shop and Other Industrial Classes.

The Kempsmith Manufacturing Company has a class for apprentices, meeting one hour per week, in which shop mathematics is taught. Eight apprentices do work in this class. Every second week a number of the company's machinists come into the class, for the hour. There are in this plant a number of foremen and gang bosses taking courses, who cannot leave their work in the shop to attend the class meeting.

These men are taking Mechanics, Strength of Materials, etc., and are seen in the shop, by the instructor, before the regular class meeting. The class meets in the office building, and as soon as the instructor appears in the shop, one of the apprentices notifies all the others that it is time for the class meeting.

At the Chain Belt Company's plant, there are two bi-weekly classes, made up of apprentices, machinists, tool-makers, etc. There are about twenty men in the two classes, each of which meets an hour at a time in the pattern shop, where a store room has been converted into a class room, by the addition of chairs and a blackboard. The instructor goes through the shop before the class meeting and notifies the men. Where the classes meet but once in two weeks it is necessary to notify the men before each meeting or it is liable to be forgotten.

Similar bi-weekly classes are held in the following plants in Milwaukee: Bucyrus Co., Cutler-Hammer Co., Wisconsin Motor Co., Beaver Mfg. Co., Filer & Stowell Co., Wisconsin Bridge Co., Avery Scale Co., Power & Mining Machinery Co., Worden Allen Co., and the Kearney & Trecker Co., the latter class being held in the boiler room as no other class room is available. Bi-weekly classes on company time are also held in the plants of the Modern Steel Structural Co., and the Waukesha Motor Works at Waukesha; and at the Gilson Mfg. Co., and the Western Malleable & Grey Iron Co. at Port Washington. The J. I. Case Co., Racine; the Fairbanks Morse Co., Beloit; and the Wisconsin Engine Co., Corliss; furnish a class room for bi-weekly class meetings but do not give the men the time to attend the class, so these classes are met outside of working hours.

A class in Dynamo Electric Machinery, made up of twenty employees of the Milwaukee Electric Railway & Light Co., meets once a week in the company's office building. The men in this class are mostly power salesmen who have had good general training and want to become familiar with electrical work as applied to their business of selling power. The electrical work is done entirely by class work, that is there is no correspondence study in connection with it. The assignments are given out by the instructor and are discussed in the class meeting.

A drawing room has been equipped in the Milwaukee office, in which classes in mechanical drawing are held in the evening. The drawing classes meet once a week in this room for a two hour period.

In connection with the West Allis High School, evening classes are held twice a week in drawing and once a week in shop mathematics.

In addition to the class work, the office is open four evenings a week and Saturday afternoons, at which time students come in for help in various subjects. About forty students weekly take advantage of this chance to obtain help in their studies.

Allis Chalmers Company.

The plan of the Allis Chalmers Company, which at present has no system of instruction for their 540 apprentices, is to cooperate with the University in giving instruction in mathematics and drawing to these apprentices.

These apprentices are in the Machine, Pattern Making, Electric Working, Moulding and Tool Making Trades, and the courses are to be adapted, as nearly as possible, to the requirements of the

different trades.

The company will probably pay a part of the cost of instruction, and may furnish one instructor, who will also have charge of the apprentices' shop work. The instruction will probably be in the evening, as this company is opposed to giving instruction to the men on company time. In their Reliance plant, this company has furnished a class room and allows the men to attend class during working hours, subject to loss of pay for time spent in class work.

Results of Extension Work in Milwaukee District.

The numbers of active students in industrial subjects, in the Milwaukee District, are as follows:

Shop Mathematics.....	275
Mechanical Drawing.....	125
Electrical Subjects.....	50
Mechanical Subjects.....	50
Structural Subjects.....	50
Mathematics.....	50

Of these 600 students, about 400 are reached in the different shop classes, and about 100 come to the office regularly for help. The others do their work by correspondence, with perhaps an occasional trip to the office.

There are about 400 students in business courses, and work for University credit in the Milwaukee District.

The chart shows the location of classes and the extent of territory covered by the Milwaukee District.

LOCATIONAL CHART
OF
UNIVERSITY EXTENSION ACTIVITY
IN
MILWAUKEE DISTRICT.
FEB. 1, 1911.

PORT WASHINGTON

25 MILES

7 MILES

No. MILWAUKEE

61

MILWAUKEE
OFFICE

10 MILES

CUDAHY

So. MILWAUKEE

23 MILES

RACINE

CORLISS

7 MILES

W. ALLIS

7 MILES

WAUKESHA

18 MILES

85 MILES

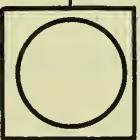
JANESVILLE

85 MILES

BELoit

MADISON - 85 MILES

UNIVERSITY
OF
WISCONSIN



Among the shop classes, those which meet weekly on company time, are the most successful. The men take an interest in the work when they see that the Company is willing to do something for them by giving them their time, and get into the habit of attending regularly. The apprentice classes are particularly successful, on account of the amount of time devoted to the work, and the interest of the students and the plant management.

In the bi-weekly and evening classes the question of attendance is a serious one, as the meetings do not occur often enough to hold the man's interest, and he often forgets about the class in the two weeks between meetings. Wherever the class is held in the shop, the instructor goes through before the class and reminds the men that it is time for the meeting, and in case a man is unable to leave his work long enough to attend class, the instructor helps him, if possible, while in the shop. In a number of plants the different foremen notify the men when the instructor appears.

In all the shop classes the instruction is individual, as the men are urged to do the work as fast as possible, and they become separated, as far as lessons are concerned, in one or two class meetings. Often times in particular cases, the regular work is supplemented by special problems, suited to the needs of the individual; or parts of assignments may be omitted if unsuited to the student. Algebra and formulas are the subjects which cause the shop-men the most trouble; if he can handle these subjects, problems in shop mechanics, strength of materials, etc., usually do not present many difficulties. The drawing work presents difficulties, as most shop men find it hard work to handle instruments, as they are not

accustomed to using their fingers.

A comparatively small per cent of the total number of persons enrolled in courses, have finished the work for which they registered. In courses of this kind where the men are not seen every day, it cannot be expected that a large per cent of the men will complete the courses. In the shop apprentice classes, the students work under favorable conditions and practically all finish the work in the allotted time. The apprentices in these classes are those picked out by the shop management as the most promising in the shop, which fact, accounts in a large measure for the good work done in these classes.

Field of Usefulness of Extension Work.

Persons who are benefited by Extension courses may be divided into two general classes, first, those who wish to continue their education, along such lines as will enhance their opportunities or abilities in their chosen profession or vocation, or along such lines as may increase their general culture; second, the great class of workers, who cannot leave their employment to acquire the training which would increase their proficiency and skill.

The first class may be roughly divided into (1) those who wish to take advantage of the courses offered by the University in keeping abreast of the times with reference to the advances in knowledge relating to their profession or business; (2) those who wish to enter the University, but lack the preparation necessary for entrance; and (3) those who wish to do work for credit towards a University degree, as nearly all systems of Extension work have provided

courses which to a limited extent may be applied as credit toward a degree. The second class, and the one to which Extension courses should offer the greatest benefits is made up of (1) those whom the necessity of earning a livelihood has taken from school before their elementary education was secured; (2) those who have secured an elementary and perhaps a more or less liberal education, but have received no special training of value in their chosen vocation; and (3) those who are in a line of work to which their tastes and abilities are unsuited and who wish to take up something more to their liking.

University Extension courses at present teach principles rather than methods of industrial work, and offer to tradesman an opportunity to further their education, not offered by any other institution. The apprentice who is working in a shop, where apprentice instruction does not prevail, has a chance to learn the principles of his trade while learning methods and operations of that trade in the shop. The journeyman who has not learned the theoretical elements of his work, can become acquainted with them without leaving his work.

The manufacturers are favorable to University Extension work as it offers a solution to the skilled labor problem, in a manner most satisfactory to themselves, as those manufacturers who cannot give apprentice instruction a prominent place in their plants, are able to secure this instruction for their men at a minimum expense and under favorable conditions.

University Extension does not interfere with the work of the Trade Schools or Engineering Colleges, as it serves a class of

men, not reached by these institutions.

Reaching as it does those men who cannot leave their work to further their education, University Extension must occupy the foremost rank in furthering industrial education, for it is this great mass of workers who must be trained and educated by other means than by the Trade School, Engineering School and University, for these institutions serve but a small percentage of those who are dependent upon a trade for a living, and comparatively few workers have a chance to learn their trade in a shop having an adequate apprenticeship system.

Growth and Future Development.

The rapid growth of University Extension in Wisconsin, from twenty-six students, January 1st, 1907, to 5870, January 1st, 1911, is an evidence of the value of the work.

The future of Extension Work as planned in Wisconsin, is for a state wide University, offering class work throughout the state, as it is carried on at present in Milwaukee.

The map shows the state divided into the proposed districts and district cities or centers.



MAP OF WISCONSIN
SHOWING
PROPOSED DISTRICTS AND DISTRICT CITIES
FOR
EXTENSION WORK.





UNIVERSITY OF ILLINOIS-URBANA



3 0112 086857924